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(71) Applicant *(for all designated States except US)*: OY ALKO AB [FI/FI]; Salmisaarenranta 7, FIN-00180 Helsinki (FI).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : KOISTINEN, Tarja [FI/FI]; Toivojentie 6, FIN-05200 Rajamäki (FI).

(74) Agent: LÖNNQVIST, Gunnel; Oy Alko Ab, Law Department/Patents, P.O. Box 350, FIN-00101 Helsinki (FI).

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(54) Title: COMPOSITIONS AND METHODS FOR COATING SEED

(57) Abstract

The present invention is related to a seed coating which is beneficial for the germination of seeds. A polysaccharide derivative hydrolysate, especially a hydrolysate of carboxymethyl cellulose (CMC) or carboxymethyl starch (CMS), is used as a binder, which is capable of binding pesticides and herbicides and talcum as a thin, even and unspotty film. In the method according to the invention the binder can be sprayed on the seed as a concentrated water solution, preferably a 30 % (w/v) solution.

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COMPOSITIONS AND METHODS FOR COATING SEED

THE BACKGROUND OF THE INVENTION

1. The Field of the Invention

The present invention is related to a seed coating composition and a method for coating seeds with polysaccharide derivative hydrolysates.

2. The State of the Art

Seeds are coated to improve germination, to retain humidity and bind pesticides, herbicides and fertilizers.

Commonly used coatings are polyacrylates (WO85/01736) and different starch compositions (US 4,250,660). In the patent US 4,250,660 a 3-5 % binder solution of unhydrolysed carboxymethyl cellulose (CMC) is described.

Unhydrolysed polysaccharide derivatives have a relatively low solubility in water. CMC is the most water soluble of the unhydrolysed polysaccharide derivatives. In spite of that, it is an acknowledged fact that, when the amount of unhydrolysed polysaccharide derivatives, especially CMC, is raised, the viscosity of the solution increases rapidly. The increase of viscosity makes the handling of the solution difficult, e.g. pumping or spraying of the solution is impossible. A dilute solution of unhydrolysed CMC on the other hand is not capable of binding the coating strongly enough.

To improve the feasibility of unhydrolysed CMC in seed coating, CMC has been combined with other substances. Unhydrolysed CMC has been used as very dilute solutions (0,5 - 1 %) for coating cotton seeds in combination with lignin (SU 1,015,837).

When seeds are coated with unhydrolysed polysaccharide derivatives, cleaning of the equipment is very tedious. Toxic wastes containing pesticides and herbicides are produced. The destruction of such hazardous wastes always causes problems.

The present invention is based on experiments performed with polysaccharide derivative hydrolysates, especially CMC and CMS-hydrolysates. The results indicate that the solubility and viscosity of polysaccharide derivatives differ greatly. We have observed that a hydrolysed CMC can be pumped as a 40 % (w/v) solution, whereas the most water-soluble of the polysaccharides, CMC, and more specifically a brand of CMC, which has an especially low viscosity, can be pumped only when the concentration of the solution is less than 10 % (w/v).

Said observation indicates that polysaccharide derivative hydrolysates, preferably CMC- and CMS-hydrolysates, are extremely suitable for coating seeds, especially seeds from oleiferous plants.

THE SUMMARY OF THE INVENTION

The present invention provides a seed coating composition, which as a binder uses polysaccharide derivate hydrolysates, preferably CMC- or CMS-hydrolysates, which can be used as sufficiently concentrated solutions. The viscosity of the solutions is still so low that solutions, which can be pumped or sprayed, are easy to prepare and handle.

Particularly, the present invention provides a new method, in which the coating does not adhere to the walls of the coating equipment and the solution, which has been sprayed on the walls, is easy to rinse away with water alone.

The method is especially suitable for coating seeds from oleiferous plants. Seeds from such plants are known to be difficult to coat, because of their extremely oily and slippery surface.

The present invention provides a coating, which comprises a tight, non-spotty, durable film, which decomposes easily in the soil.

The present invention also provides a coating, which neither adheres to the equipment nor produces seed clusters. The coated seeds should preferably be separate. It is also important that the germination is not disturbed by the coating or binder.

Furthermore, the present invention provides a binder, which is capable of binding pesticides, herbicides, nutrients, fertilizers or microbes as well as talcum to the surface of the seed as a thin, durable, unspotty film.

Polysacharide derivative hydrolysates, especially CMC-hydrolysates but also CMS-hydrolysates, which can be used as sufficiently concentrated solutions, e.g 5 - 50, preferably 10 - 40, most preferably 30 % (w/v) water solutions are suitable binders for seed coatings according to the present invention.

The cellulose or starch derivative hydrolysates according to the present invention should have an average degree of polymerisation in the range of 3 - 500, preferably 5 - 300, most preferably 5 - 100 and they are optionally substituted by carboxymethyl, methyl, methylethyl, hydroxypropyl, hydroxypropylmethyl or hydroxyethyl groups.

It is important that the polysaccharide derivative hydrolysate used in the method of the present invention can be pumped or sprayed on the seeds.

THE DETAILED DESCRIPTION OF THE INVENTION

The polysaccharide derivative hydrolysates used as coatings for seeds are preferably hydrolysates of cellulose or starch derivatives. The average degree of polymerisation of the hydrolysates is in the range of 3 - 500, preferably 5 - 300, most preferably 5 - 100. The cellulose or starch is preferably substituted by carboxymethyl, methyl, hydroxypropyl, hydroxypropylmethyl or hydroxyethyl groups. The properties and preparation of said hydrolysates of polysaccharide derivatives used as seed coatings are described in more detail in the following patent applications EP 382 577, EP 382 576, EP 382 578, EP 470 855, EP 470 870, EP 470 872, EP 470 871 and US 07/743,152.

Such preparations are produced preferably by enzymatic degradation from substantially purified polysaccharide derivative solutions. These solutions are relatively dilute. Because the product is dried after the degradation, very concentrated water solutions, containing up to 40 % (w/v) of polysaccharide derivative hydrolysate in water can be produced. These solutions are easy to handle because they have a relatively low viscosity in spite of the concentration.

The polymerisation degree or molecular weight as well as concentrations and viscosities for some representative starting materials for the polysaccharide derivative hydrolysates as well as the polysaccharide derivative hydrolysates are shown in the Table 1.

The viscosities were determined with a Haake viscosimeter. The viscosity of a 30 % water solution of unhydrolysed CMC and CMS could not be measured. The viscosity of a 2 % water solution of hydrolysed CMC or CMS was negligible.

Table 1

POLYSACCHARIDE DERIVATIVE	VISCOSITY/CONCENTRATION	
	UNHYDROLYSED	HYDROLYSED
CMC	12 mPas/ 2 %	34 mPas/ 30 %
CMS	5 mPas/ 2 %	20 mPas/ 30 %

Seeds from e.g tomato, wheat, oats, oleiferous plants, soft wood (conifers), beets, maize, cotton and vegetables are coated with a thin film of a composition containing binders, active components and fillers. The coating is used to improve germination by increasing the retention of moist. A good capability of binding pesticides, herbicides, fertilizers, nutritions and advantageous microbes also improves the quality of the seeds. The method of the invention is especially suitable for coating oleiferous plants.

In coating experiments it was observed that polysaccharide derivative hydrolysates, especially CMC-hydrolysate and CMS-hydrolysates did not adhere to the surface of the the equipment. In addition, the solution sprayed on the walls could easily be rinsed away with water.

In the method according to the invention hydrolysates of the polysaccharide derivatives can be used as solutions of 5 - 50, preferably 10 - 40, most preferably 30 % (w/v) concentration.

The seed coating can be performed in mixing drums. The seeds are coated with hydrolysates of polysaccharide derivatives, preferably hydrolysates of CMC or CMS. The hydrolysates of the polysaccharide derivative form on the sur-

face of the the seed a thin film. The pesticides, herbicides, fertilizers and/or talcum adheres evenly to the thin film of the binder. It is essential that the binder does not cause the seed to form clusters. The seeds should roll freely in the drum without adhering to each others or the walls of the mixer.

The coating can also be performed in a coating equipment, which preferably has a screw driver (conveyor), on which the seeds to be treated are portioned out. On the seeds different binders and pesticides, herbicides, nutritions, fertilizers and talcum are sprayed. In seed coating, it is important that the binder remains moist until the talcum and the active ingredients have been portioned out on the surface of the seed. In seed coating the film should be even, tight, non-spotty and durable. At the same time it should be easily dissolvable in soil.

The invention is described in more detail in the following examples, in which some characteristic modes of seed coating with some conventional binders suitable for coating seeds are compared with the binder of the present invention. The examples are meant to illustrate the invention without restricting the scope of the the invention in any way.

Example 1

CMC-hydrolysates (CMC-H)

a) Tests using CMC-H as a coating

In a mixing drum seed of oleiferous plants were coated in 1,5 kg portions with CMC-H solutions of different concentrations in order to find the best CMC-H concentration for coating. CMC-H forms a uniform, thin film on the surface of the seed. The seeds do not adhere to each others or the equipment. The seeds roll in the drum without adhering to each others or the walls of the mixer. The 30 % (w/v) solution proved to be the best.

b) Tests using CMC-H as a binder

The coating equipment consisted of a 7 meter screw driver, whereon seeds were portioned out. Different binders such as CMC-H solutions and polyacrylates were compared and sprayed on the seeds. The best concentration of CMC-H was 30 % (w/v). The final percentage of the dry binder per kilogram of seed was 4 % (w/w) CMC-H. Depending upon the binder 2 % pesticide and 2 - 3 % talcum was added per kilogram seed.

The seeds coated with CMC-H remained moist until the talcum was portioned out. The talcum formed a thinner and more even film when CMC-H was used. When polyacrylate was used, the film was much more spotty. In other words the film was not even and it had holes in the film layer.

CMC-H did not form seed clusters and did not adhere to the equipment. In the method no secondary products, such as clusters or debris, containing pesticides or herbicides were produced. Thus, no hazardous wastes had to be disposed of.

Example 2

Test using polyacrylate (Uusi Kiilto) as a binder.
The test was performed as described in Example 1b using a 27 % (w/v) acrylate solution (Uusi Kiilto). The amount of dry binder per kilogram of seed was 4 - 6 % (w/w).

The binder adhered to the equipment and formed clusters of seed. The equipment had to be cleaned using strong mechanical force. The film of the coating was spotty.

The clusters, which could not be broken up, caused losses in many ways. The losses were caused partly, by the adherance to the equipment and partly, because the clustered seeds were not first class products, which could be used

and sold. Furthermore, the wastes caused problems, because they had to be treated as hazardous wastes. In addition, dust classified as hazardous was released when the seeds were screened to separate the free seeds from the clusters.

Example 3

Test using polyacrylate (Hilleshög) as a binder

The test was performed as described in Example 1b using a polyacrylate (Hilleshög) solution having a 30 % (w/v) concentration. The content of dry binder per kilogram of seed was 4 - 6 % (w/w). The results corresponds to those described in Example 2.

Example 4

CM-Starch hydrolysate (CMS-H)

a) Test using CMS-H as a coating

In a mixing drum seeds of oleiferous plants (Kesko 0303 - hard) were coated with solutions of CMS-hydrolysate as described in Example 1. The purpose of the test was to find the best CMS-H concentration for seed coating. In the test three somewhat different types of solutions of CMS-H (PRIMOJEL-K, CMC-H 24.28 and CMS 30.34) were used. With all these preparations similar reults were achieved. In all tests the 30 % (w/v) CMS-H solution proved to be the best.

b) Test using CMS-H as a binder

The coating device was a 7 meter long screw driver, on which the seeds were portioned out. A water solution containing 30 % (w/v) CMS-H described in Example 4a was sprayed on the seeds, as well as 2 % pesticide and 3 % talcum.

The structure of the coating was good and even. The pesticide and talcum added was bound exellently by the binder. CMS-H did not form clusters and it did not adhere to the surface of the equipment.

Example 5

Test with unhydrolysed CMC as a coating.

In a mixing drum 0,5 kg of seeds from oleifereous plants (Kesko 0303 - hard) was coated with with a CMC solution as described in Example 1 in order to find the best CMC concentration for the coating. In the test the CMC quality with the lowest possible viscosity (Finnfix 2) was used.

Using a 10 % (w/v) CMC-solution the coating capacity of the binder disappeared in about 3 minutes from the spraying. The reason was that the drying had started. CMC could bind neither the pesticide nor the talcum.

A 15 % (w/v) CMC-solution was so thick that it was impossible to spray it as a mist on the surface of the seeds. The CMC-solution formed droplets on the surface and clusters were formed when the talcum was added.

A suitable CMC concentration was not found, because the 10 % (w/v) solution was too dilute for binding and the 15 % (w/v) solution was too viscose for spraying.

Example 6

Germination test

The germination test was done according to standardised prescriptions (directives) issued by the Finnish State Institute for Seed Control. The seeds were germinated on blotting paper for 3 weeks in 10 °C and whereafter for 7 days in 20 °C.

The seeds were a hard brand of rape (Kesko 0303). The results are shown in Table 2.

Table 2

Coating	Germinability
Uncoated	94
Binder (27 % (w/v) solution), Uusi Kiilto, 4-6 w/v % binder/kg seed	96
Binder (27 % (w/v) solution), Uusi Kiilto 6-8 w/v % binder/kg seed	93
Binder (30 % (w/v) solution), Hilleshög 4-6 % (w/v) binder/kg seed	97
Binder (30 % (w/v) solution), CMC-H 4 % (w/v) binder/kg seed	95

The differences in germinability were not significant and the binders did not disturb germinability.

WHAT IS CLAIMED IS:

1. A seed coating composition comprising as a binder a 5 - 50, preferably 10 - 40, most preferably 30 % (w/v) water solution of a polysaccharide derivative hydrolysate, preferably a hydrolysate of a cellulose or starch derivative having an average degree of polymerisation in the range of 3 - 500, preferably 5 -300, most preferably 5 - 100.

2. The seed coating composition of claim 1, wherein the cellulose or starch derivative hydrolysate is optionally substituted by carboxymethyl, methyl, methylethyl, hydroxypropyl, hydroxypropylmethyl or hydroxyethyl groups.

3. The seed coating composition of claim 3, wherein the cellulose or starch derivative hydrolysate is CMC or CMS hydrolysate.

4. A method for coating seeds, wherein the seeds are treated with a binder comprising a 5 - 50, preferably 10 - 40, most preferably 30 % (w/v) water solution of a polysaccharide derivative hydrolysate, preferably a hydrolysate of a cellulose or starch derivative having an average degree of polymerisation in the range of 3 - 500, preferably 5 - 300, most preferably 5 - 100.

5. The method of claim 4, wherein the cellulose or starch derivative hydrolysate is a CMC or CMS hydrolysate.

6. The method of claim 4, wherein the seeds are treated by spraying.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 93/00262

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A01N 43/16, A01N 25/26, A01N 25/24, A01C 1/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: A01N, A01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	Plant Disease, Volume 69, No 12, December 1985, A. B. Filonow et al., "Evaluation of Several Actinomycetes and the Fungus Hyphochytrium catenoides as Biocontrol Agents for Phytophthora Root Rot of Soybean" page 1033 - page 1036 --	1-6
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

30/07/93

International application No.
PCT/FI 93/00262

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